The Distribution of Las Vegas Wash Water in Las Vegas Bay Following a Storm Event

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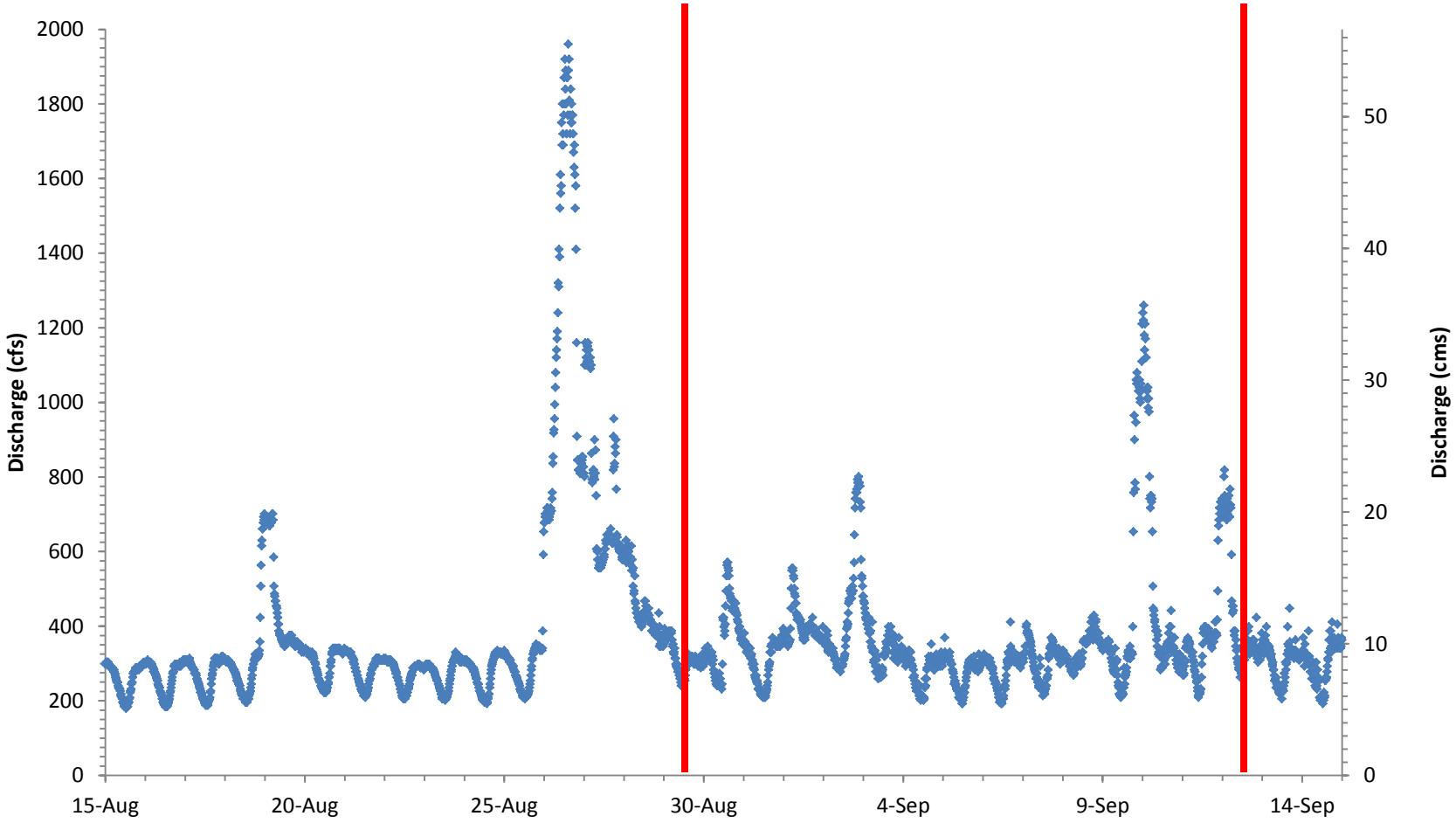
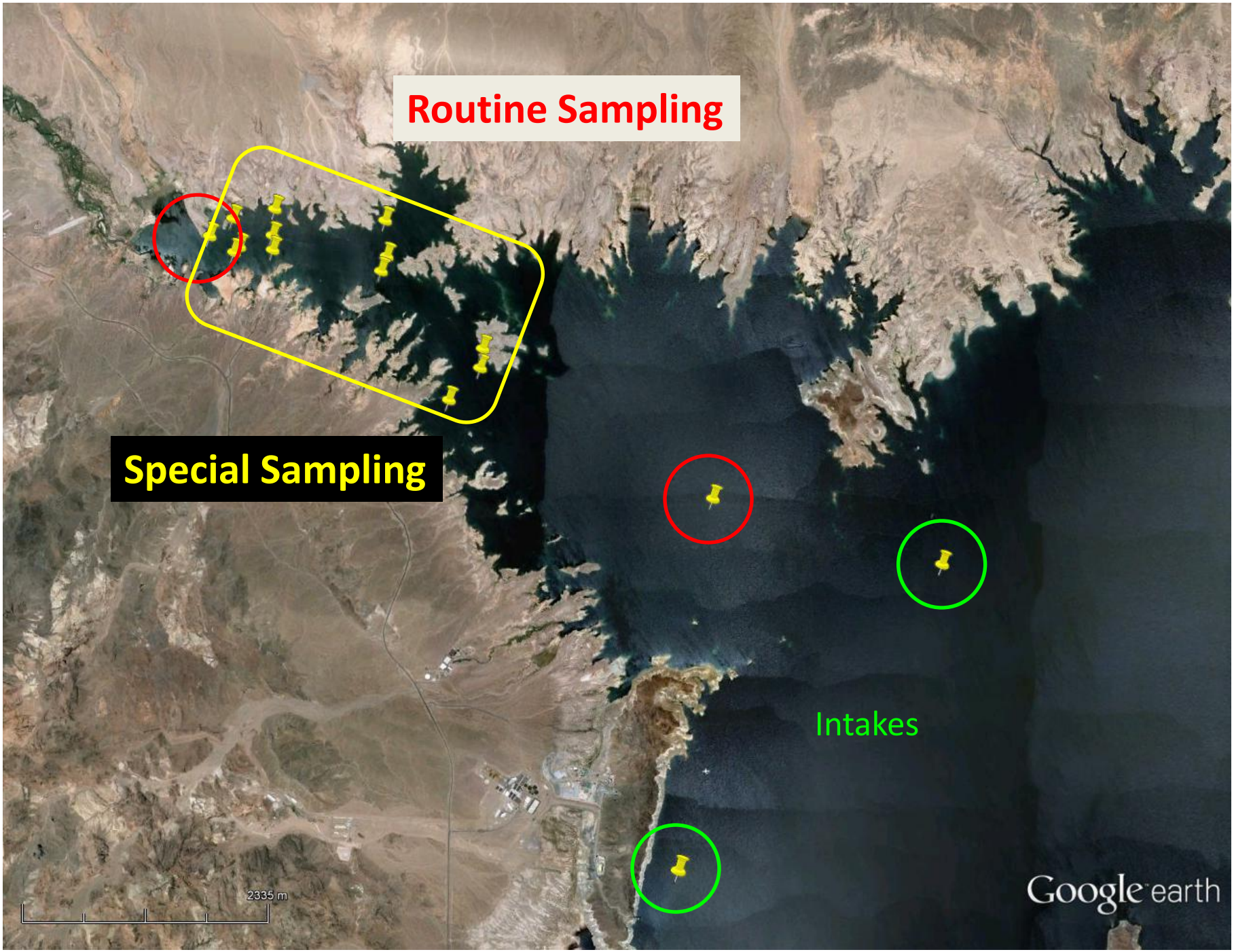
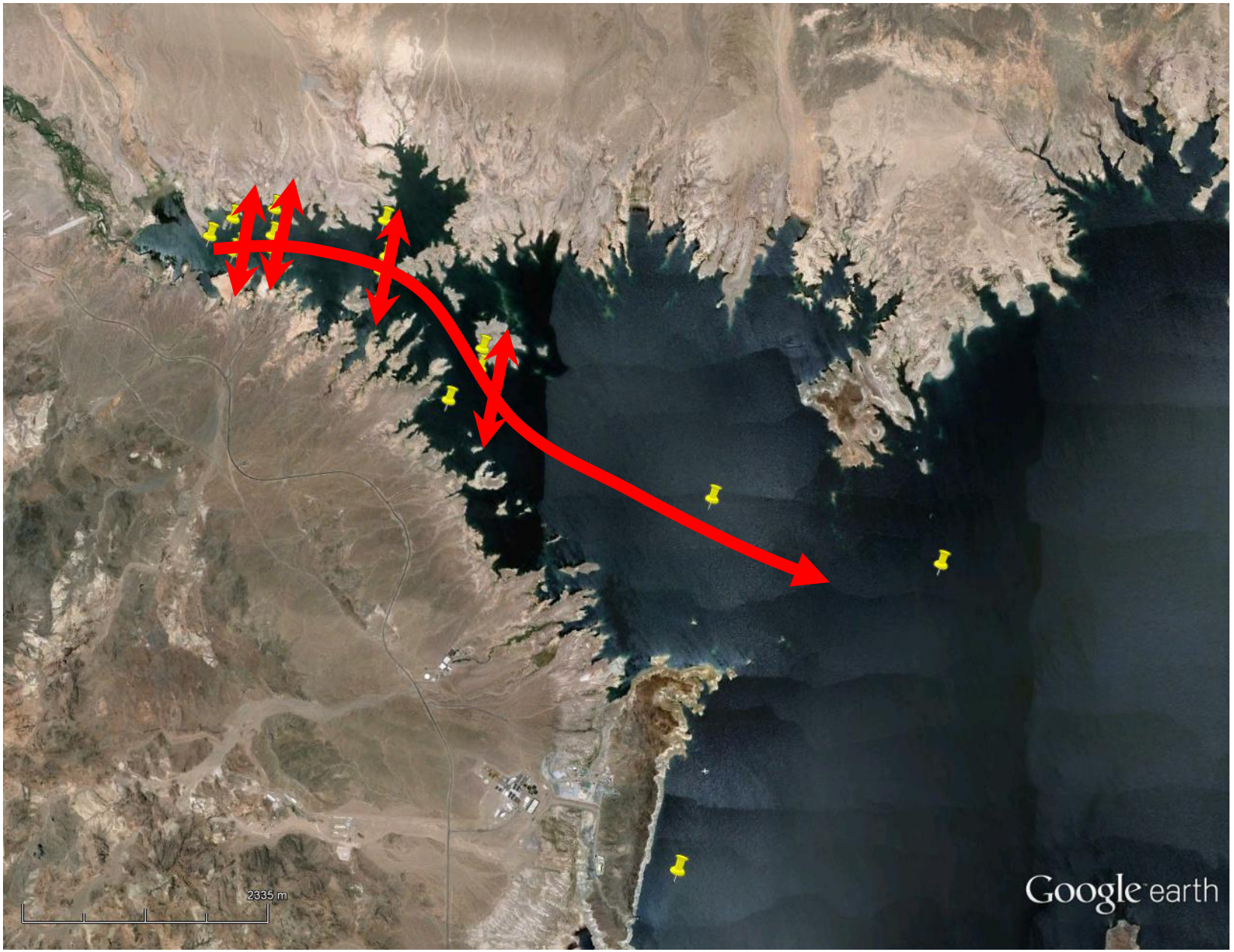
2013 Monsoon Hydrograph

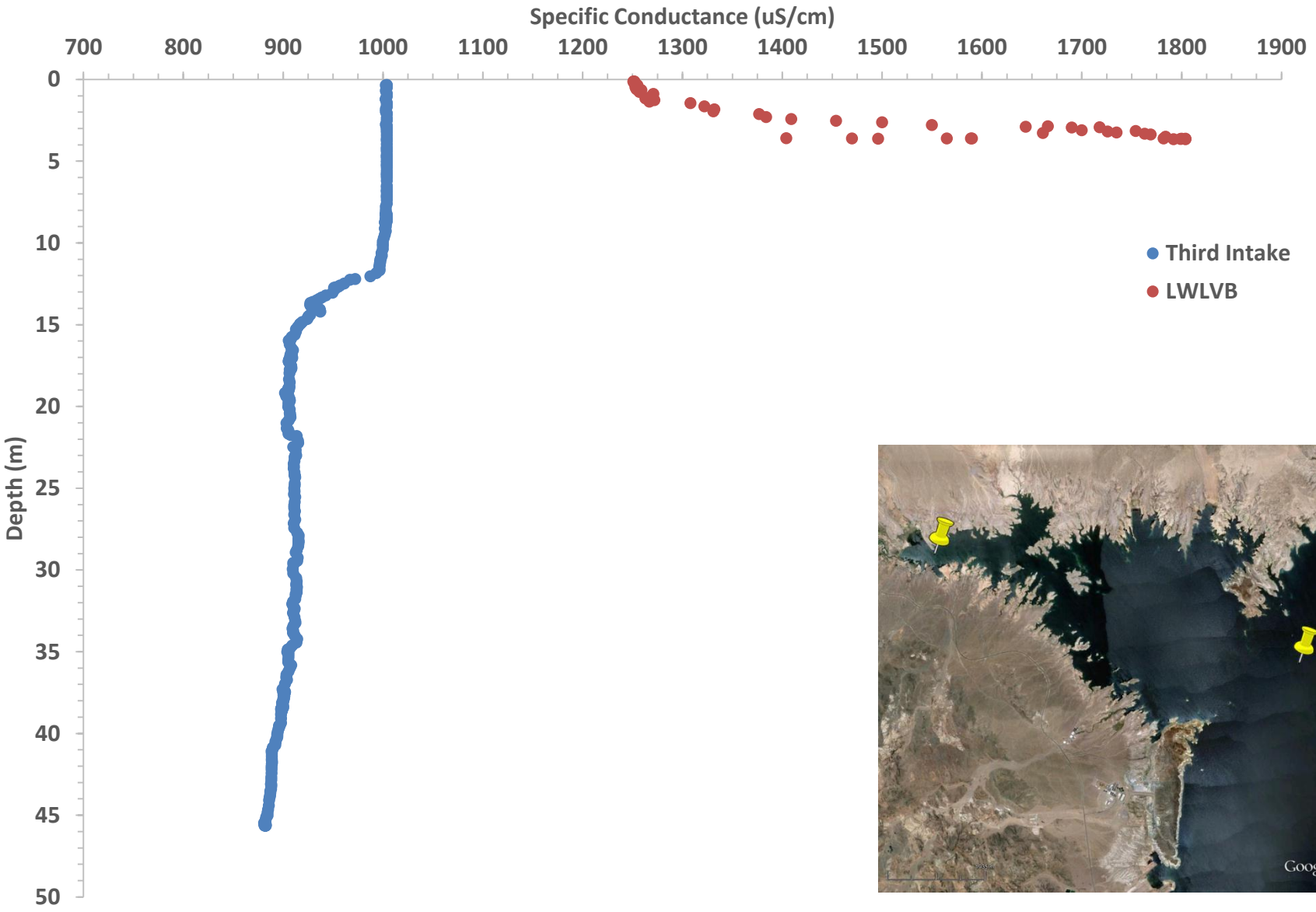


Storm Impacts: Surface


Routine Sampling
Special Sampling
Intakes
2335 m
Google earth


2335 m
Google earth

Specific Conductance



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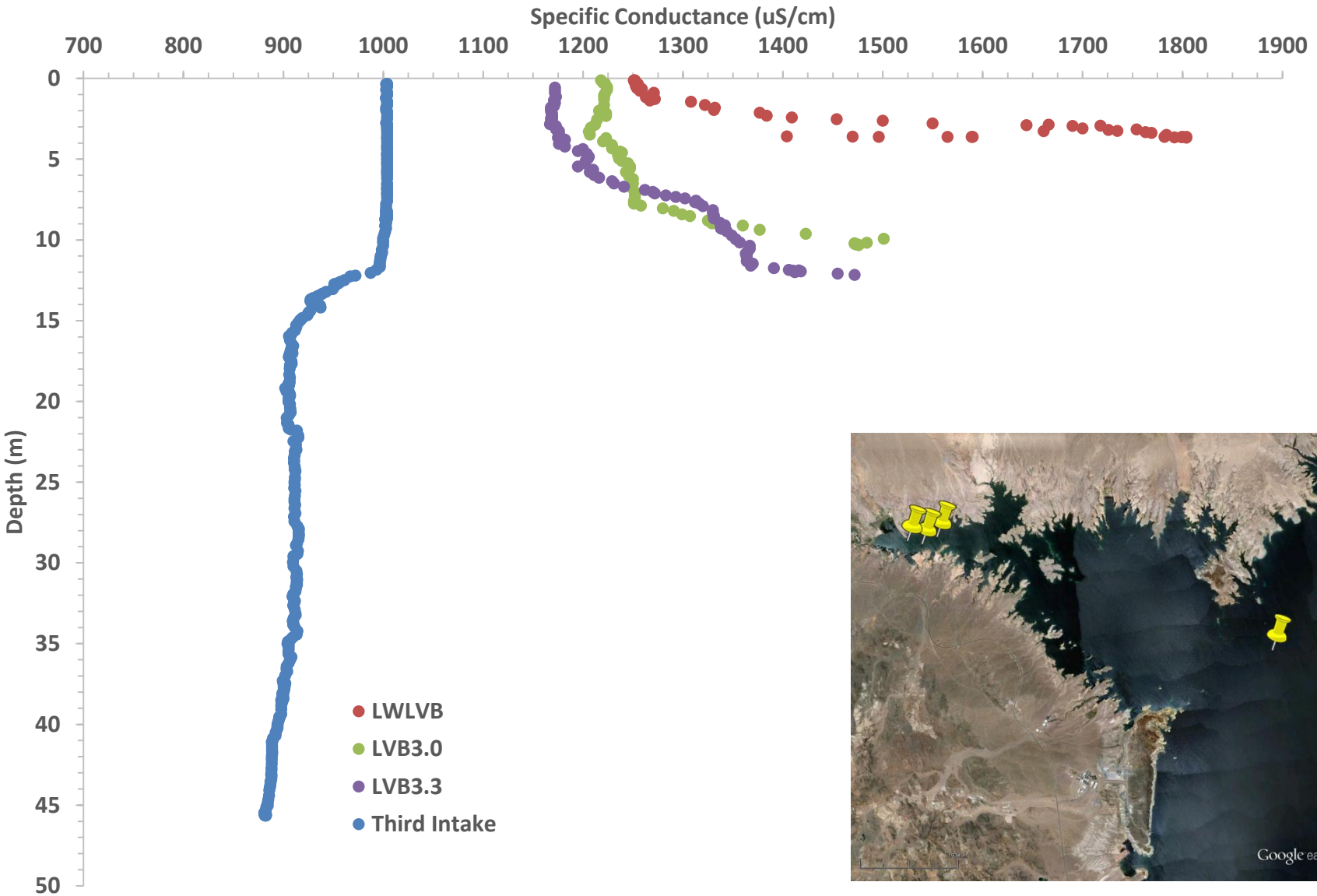

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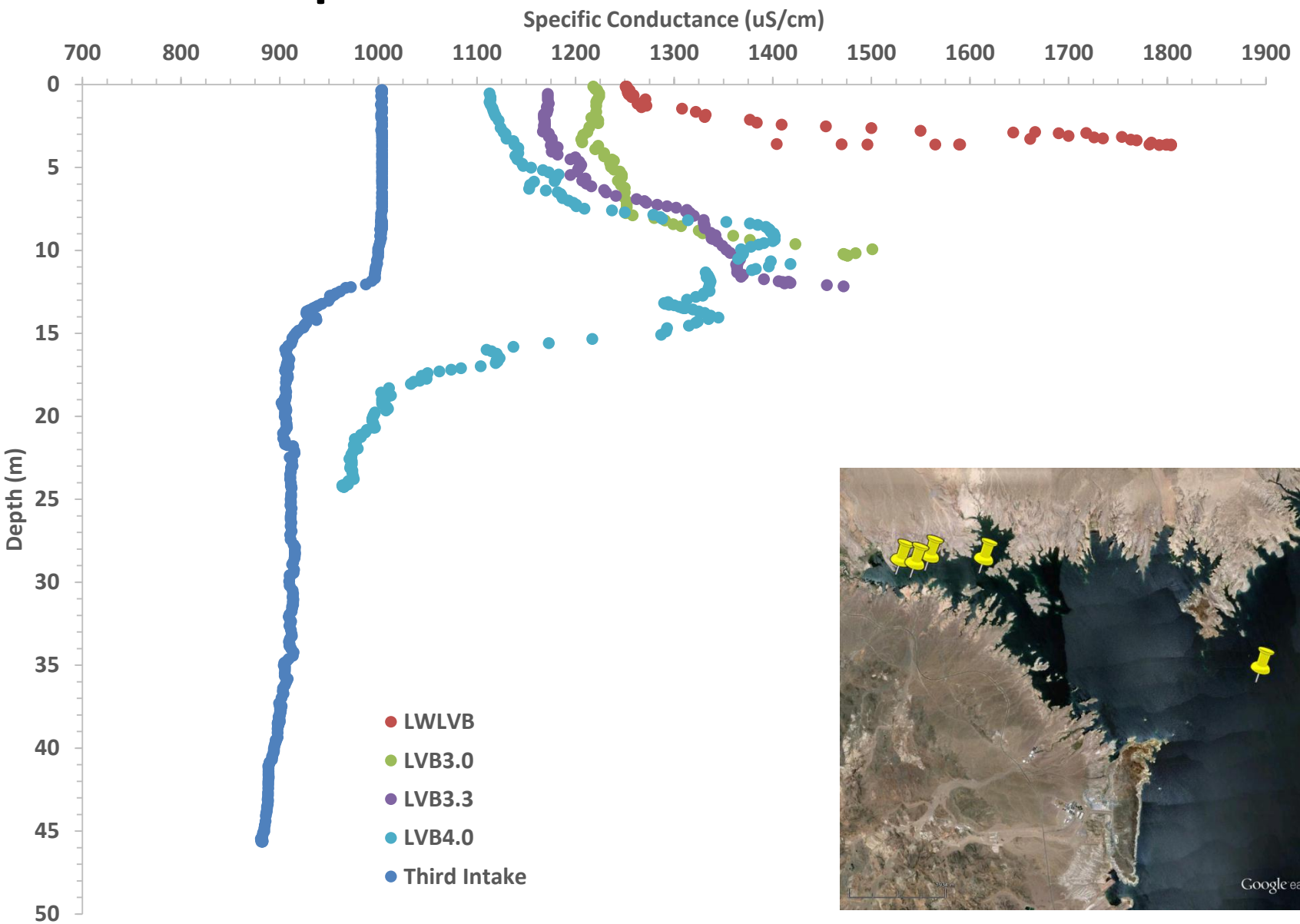
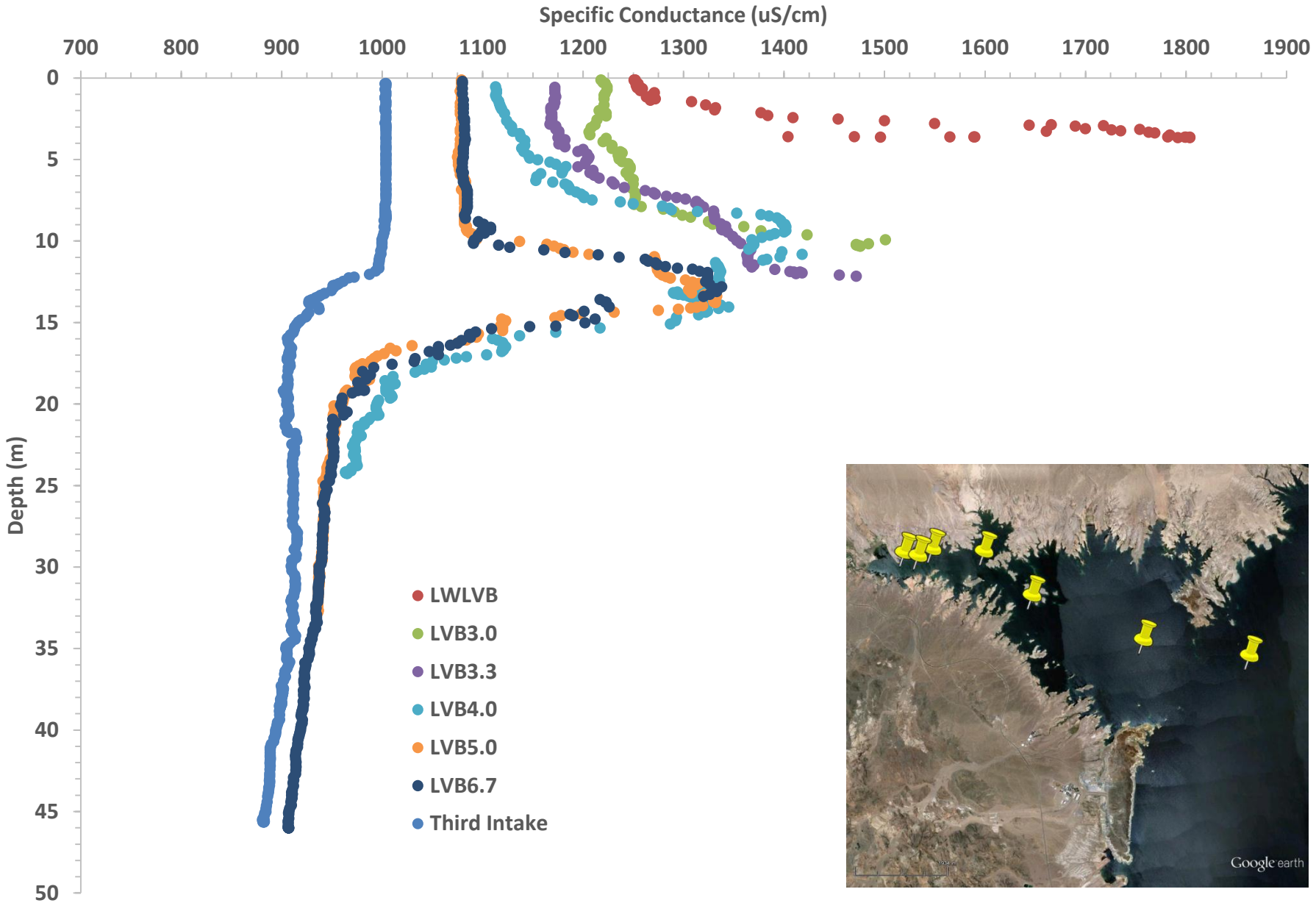


Specific Conductance



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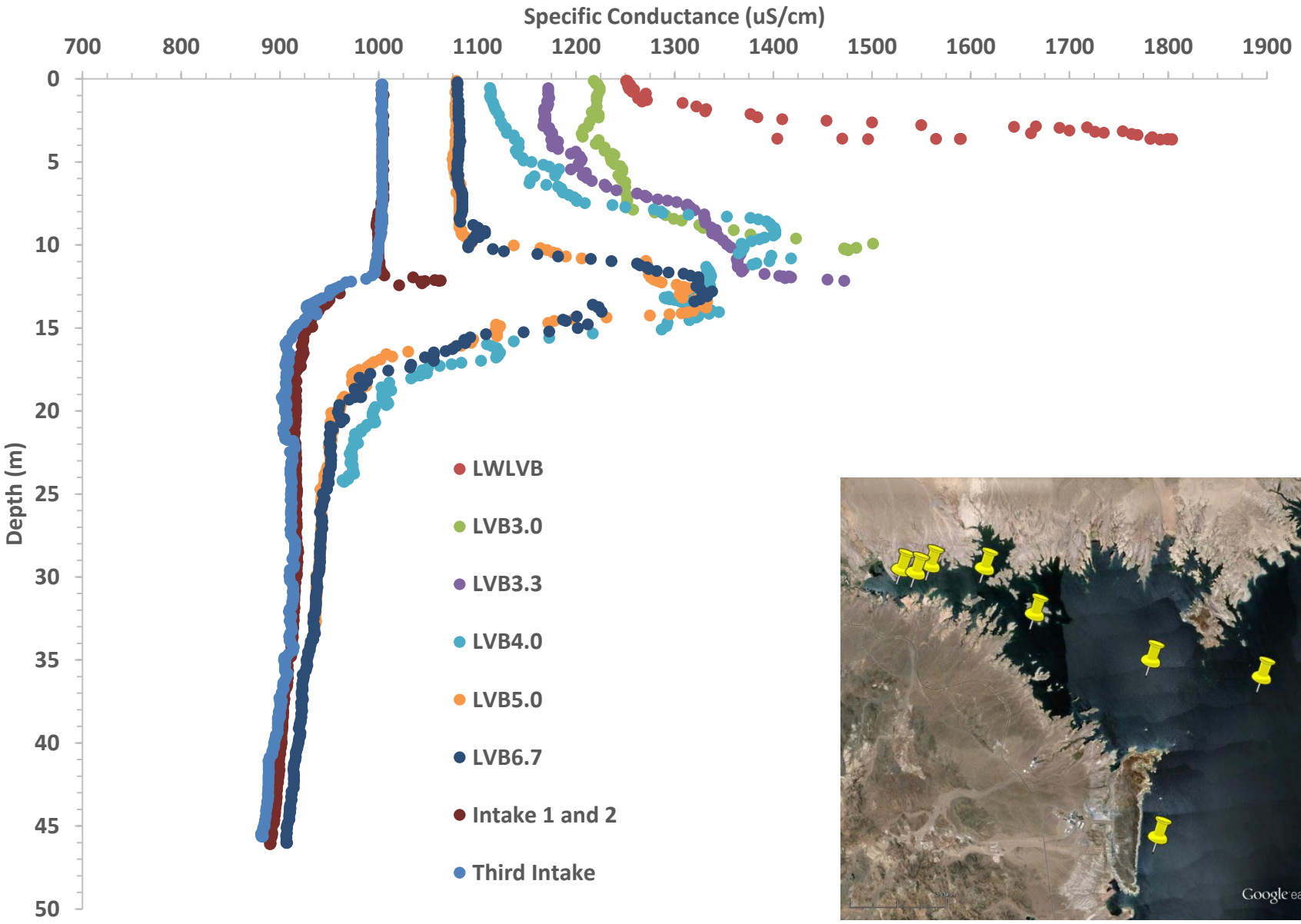


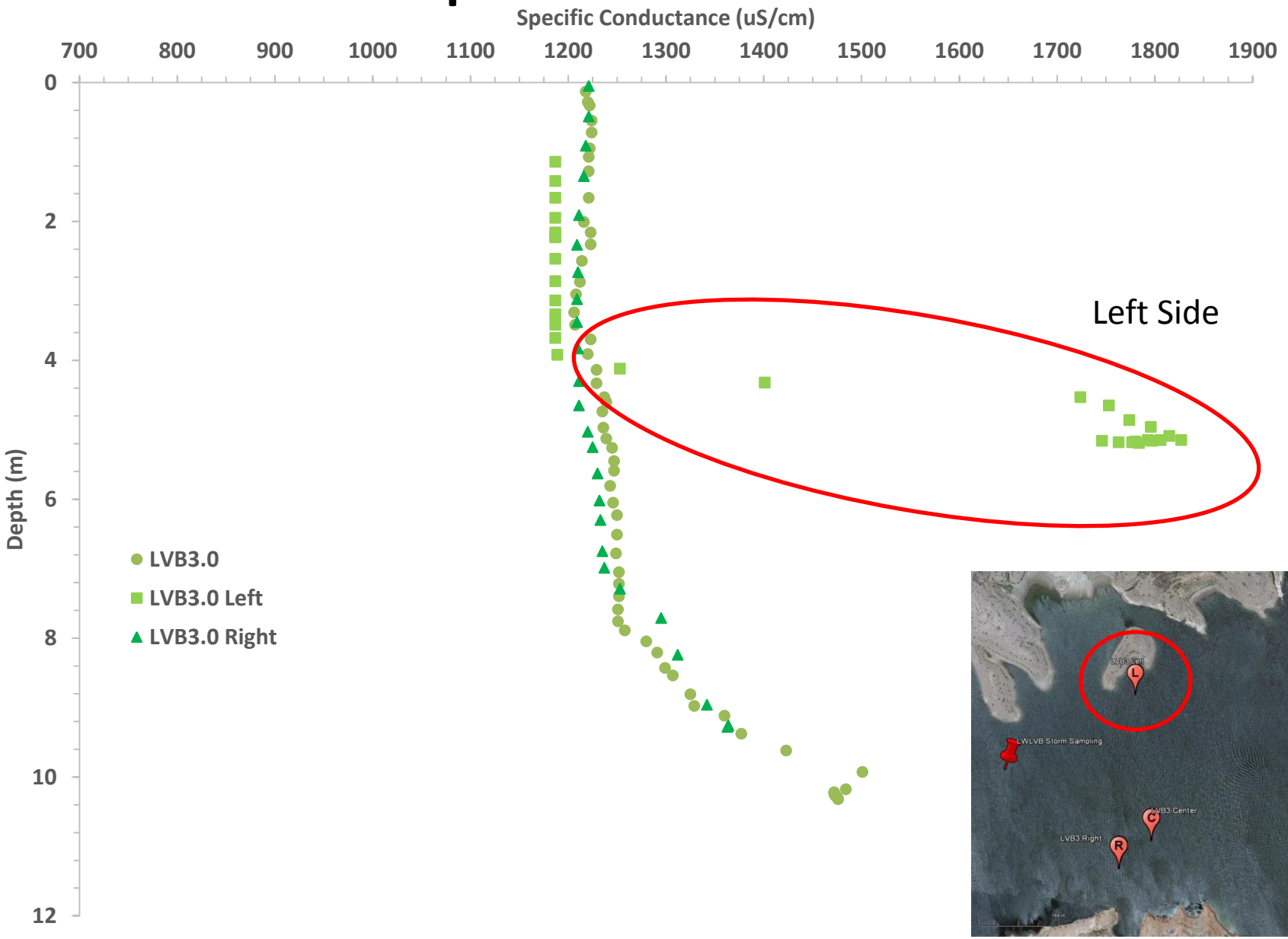
Specific Conductance

- The storm flows entered Las Vegas Bay as an underflow for the first ~0.5 miles
- The inflow then transitioned to an interflow by 1.2 miles into the bay
- The interflow persists to Boulder Basin
  - Visible at Intake 1 and 2
  - Not apparent at Intake 3

Lateral Specific Conductance

- How did the water travel across the width of Las Vegas Bay?

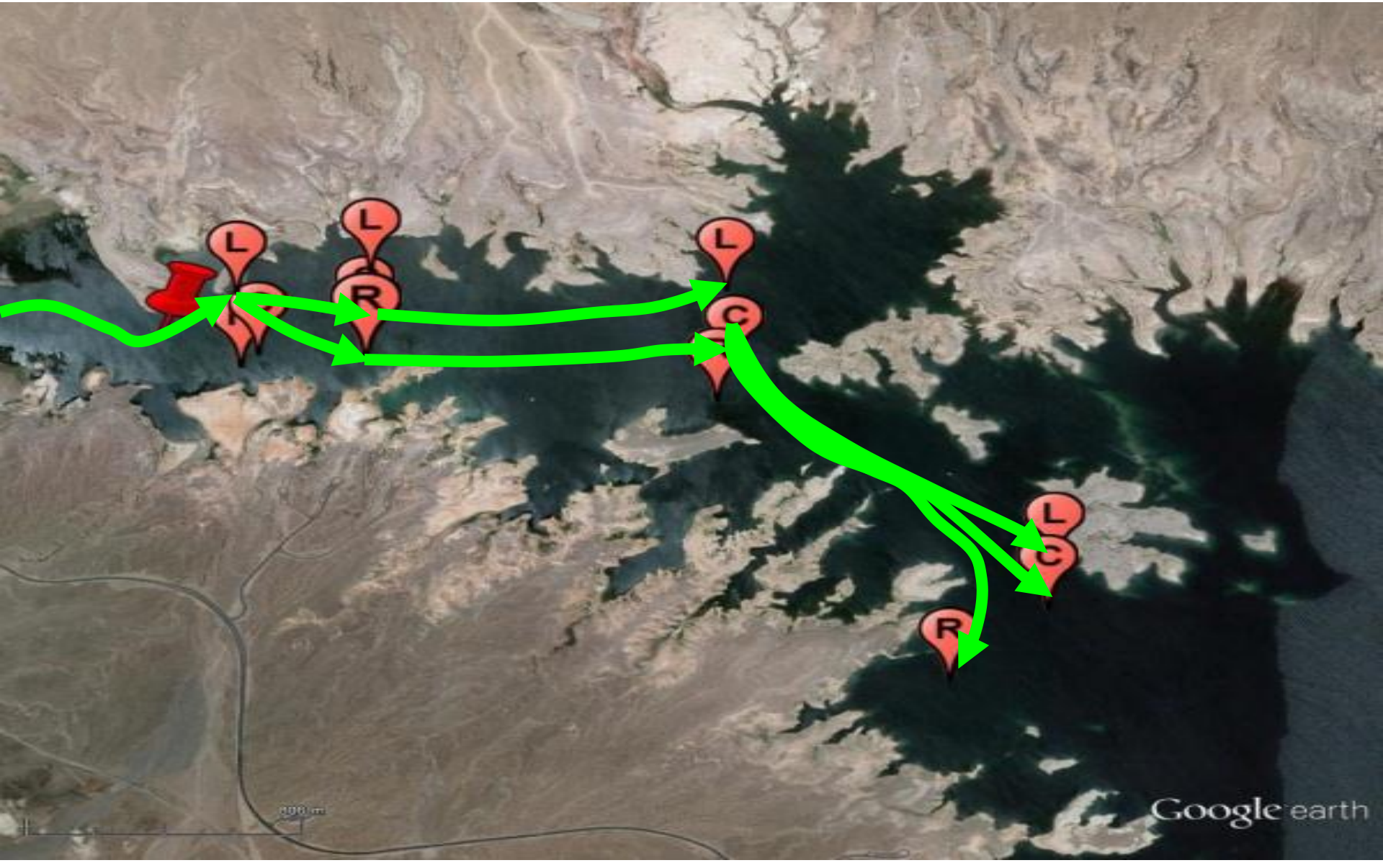
Lateral Specific Conductance



Lateral Specific Conductance

- How did the water travel across the width of Las Vegas Bay?
  - It moved from left to right
    - Was more “common” along Northern Shoreline
  - It did not follow the old river channel
  - It moved in ways that might not be predicted by surface features

Where did the Water Travel?



Turbidity

- W


1.85e
27-Aug-2013
11:19
1.85m
27-Aug-2013
11:19
1.85h
27-Aug-2013
11:19

Turbidity

- Generally followed the flow patterns determined by specific conductance
  - Underflow and Interflow
- ~3 days after the storm there was still a significant signature
- There was significant turbidity below the interflow as particles continued to settle
- A very small turbidity signature could be seen at the Intake location

Nutrients

- Getting to something we have great concerns about
  - We know from previous slides that the storm flow entered as an underflow and transitioned to an interflow
  - Did the nutrients follow the water?
    - Can we tell?
- Look at lateral and depth patterns

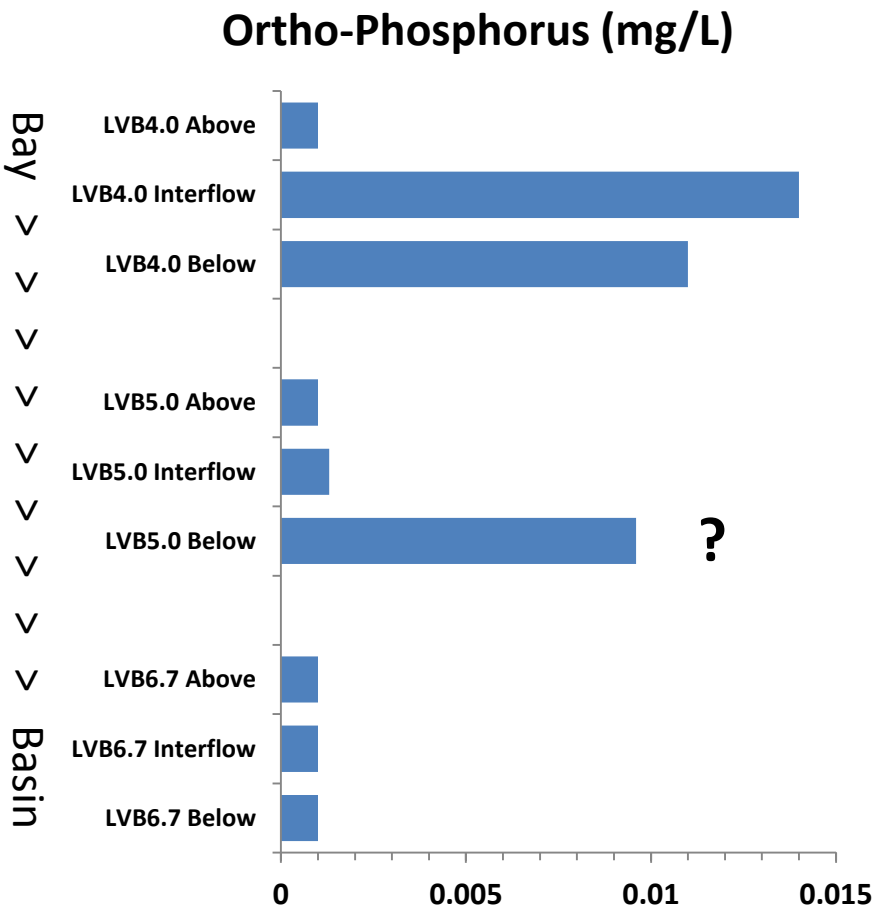
Lateral Nutrients

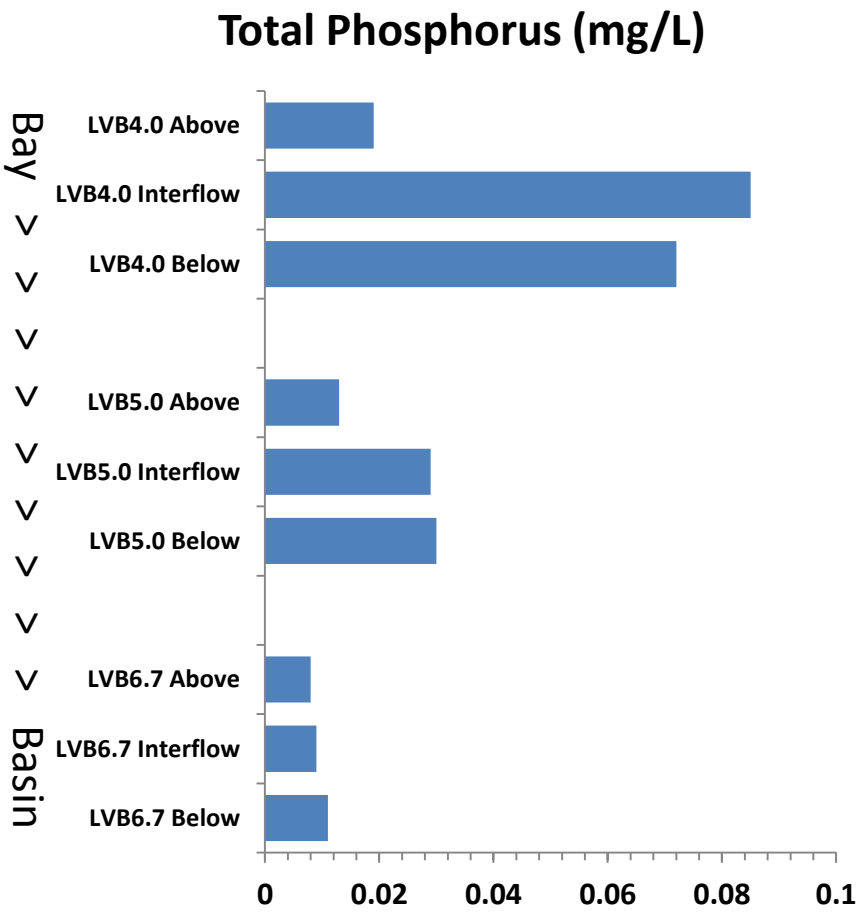
- Storm flow seems to have reached LVB4.0 (~1.25 miles from Delta) in 3 days
- Strong signatures from ammonia and ortho-phosphorus
- Strong signatures for lateral placement from all parameters
  - Generally followed pattern revealed in conductivity data (as well as could be expected)

Nutrient Depth Patterns

- For the interflow portions of the storm flow we sought to identify how the nutrients were moving up or down in the water column
  - Diffusion: up or down
  - Settling: particles headed down
- If there is significant downward flux we can continue to have reasonable confidence that storms entering Las Vegas Bay away from the surface will not provide significant nutrients to the epilimnetic algae

Phosphorus - Depth





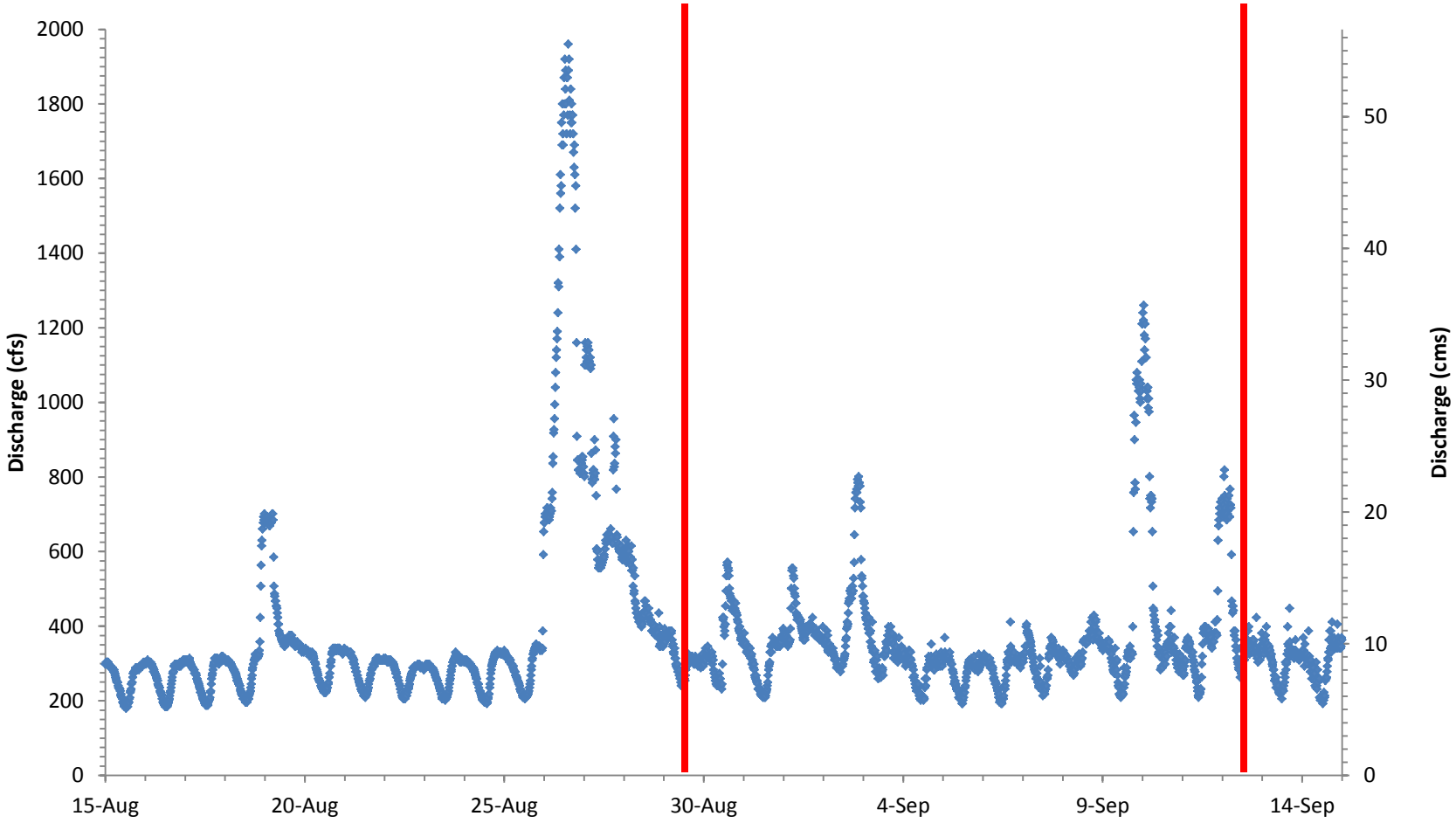
Nutrient Depth Patterns

- Diffusion was lower than our ability to detect it
  - Probably not significant enough to provide nutrients to the epilimnion for a storm of this magnitude/source
- In general the patterns were similar to turbidity; higher concentrations in the interflow but elevated below the interflow
  - Stuff is settling out
    - Dissolved nutrients are being released to the water from settling material
- LVB6.7 seems to reflect non-storm patterns
  - Very slightly higher concentrations in the epilimnion for some parameters

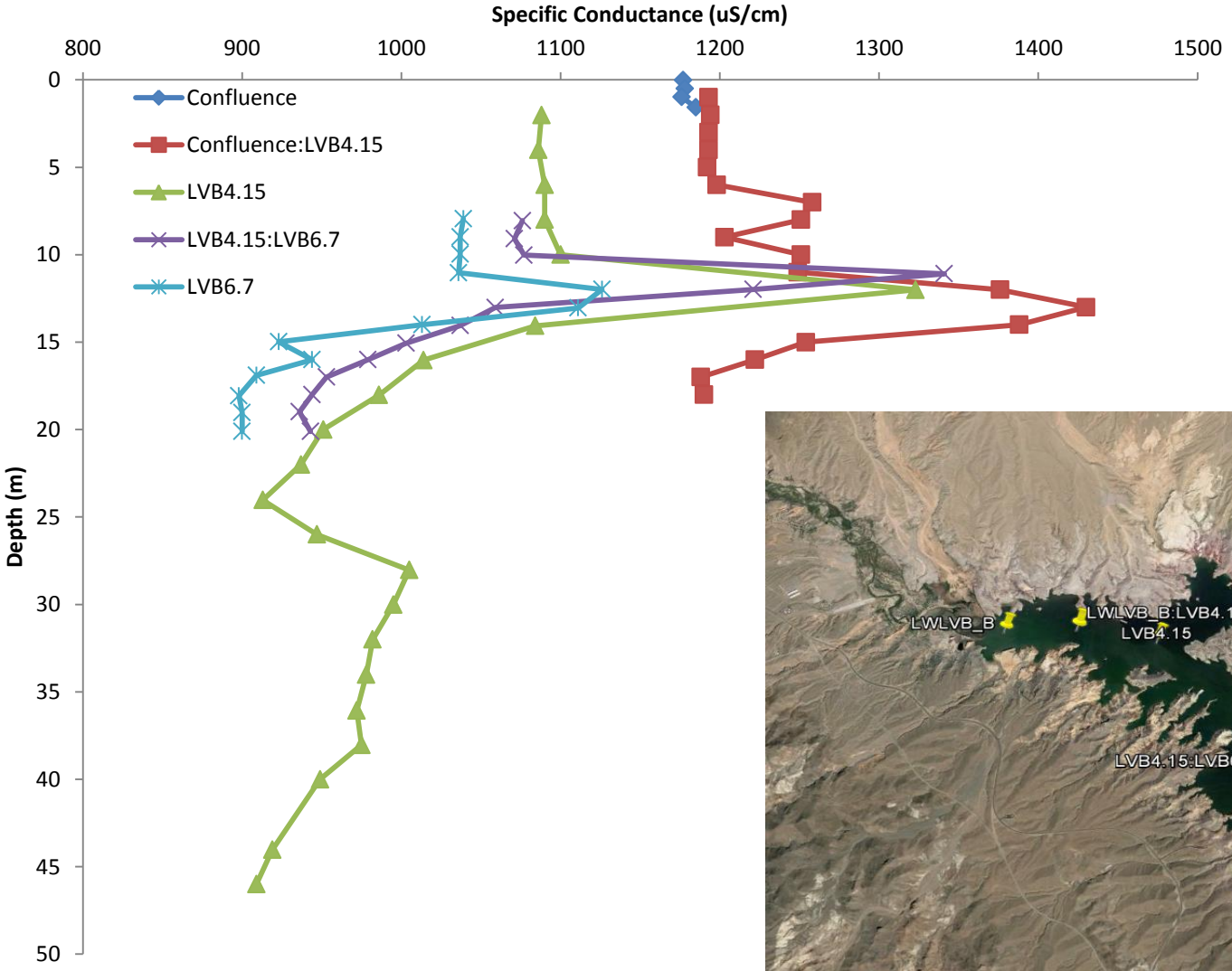
Conclusions: August Storm

- We are as smart as we think we are:
  - Storm water entered the bottom/middle of the water column
  - Storm water spread laterally from the river channel
    - We cannot really predict this, but do we need to?
  - The storm water had moved into Las Vegas Bay, but not entirely out of it, in 3 days
  - Conductivity is a good tracer for bulk flow
    - Probably not great for nutrient concentrations, turbidity might be better
  - Increases in nutrient concentrations were correlated with the interflow and water below it

September 2013 Storm



September Storm



September Storm

- Speculate that the September storm flow had only reached the sampling location between the confluence and LVB4.15
  - Small conductivity increase at ~7 m
- There is some additional evidence suggesting this might be correct
  - USBR flow velocity estimates of ~0.1 mph
- Still entering as an underflow, traveling as an interflow

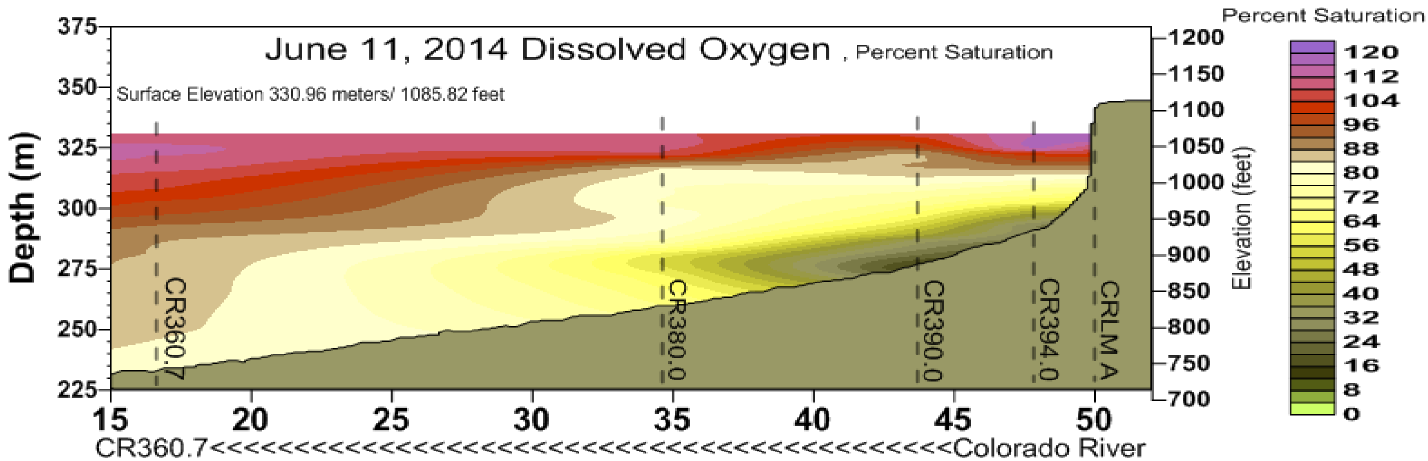
Conclusions

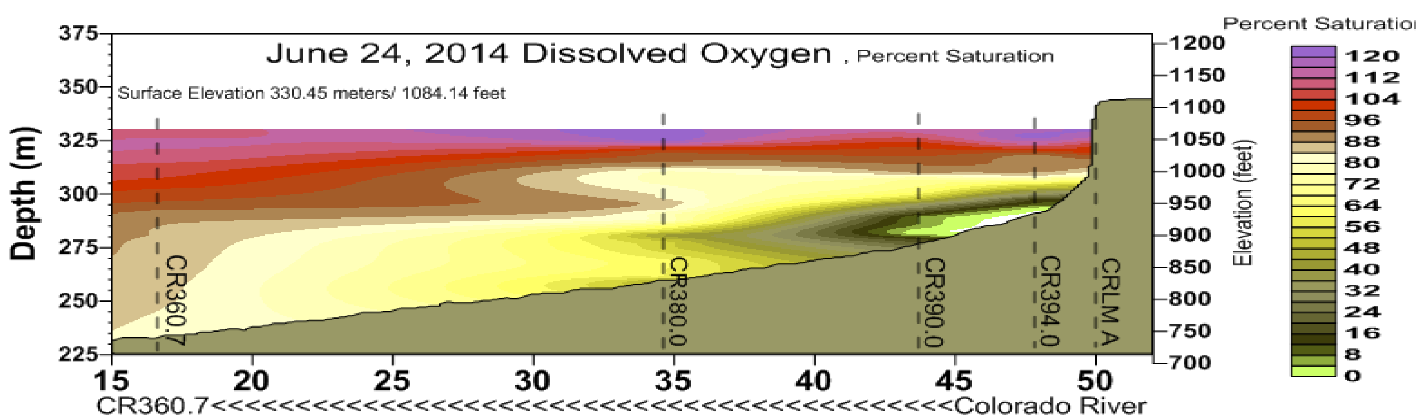
- Movement of storm water can be evaluated through sampling a few days after the storm in many cases
  - Too soon, storm water distribution limited
  - Too late, storm water dispersed
- Storm flows tend to move through the bay as we would predict
- If we desire more precise measurements of the impacts of storm flows, it will require a significant commitment of resources, time, and personnel
  - Many locations, many days, flexibility and analysis in the field

Cooperators

- Interagency Sampling Group
  - Joint Sampling event in September provided guidance for sampling
- City of Las Vegas
  - Sampling the August 26th storm (this data)
- USGS
  - Sampling of September storm
- SNWA Regional Water Quality and Laboratory

Low DO at the Colorado River Confluence





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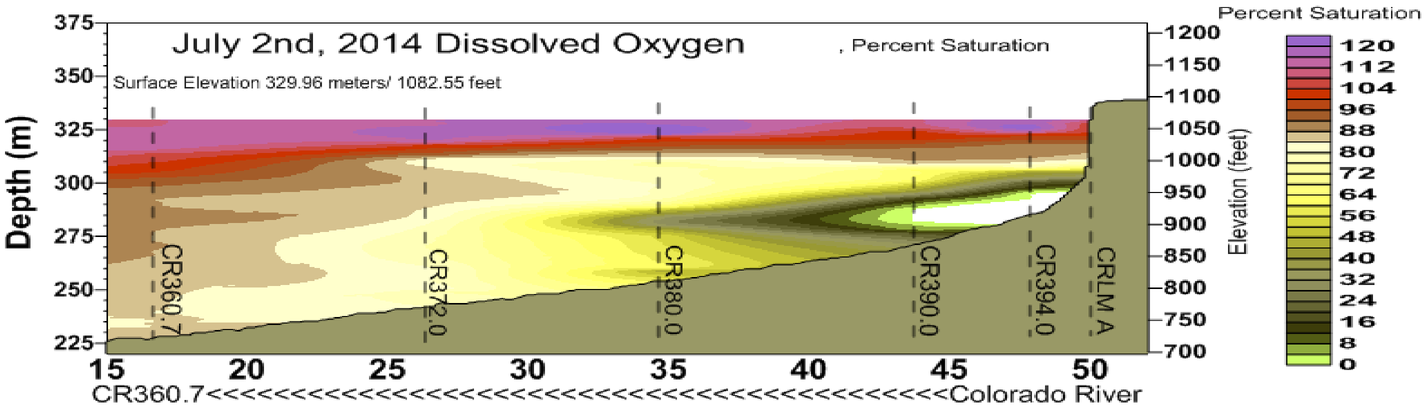

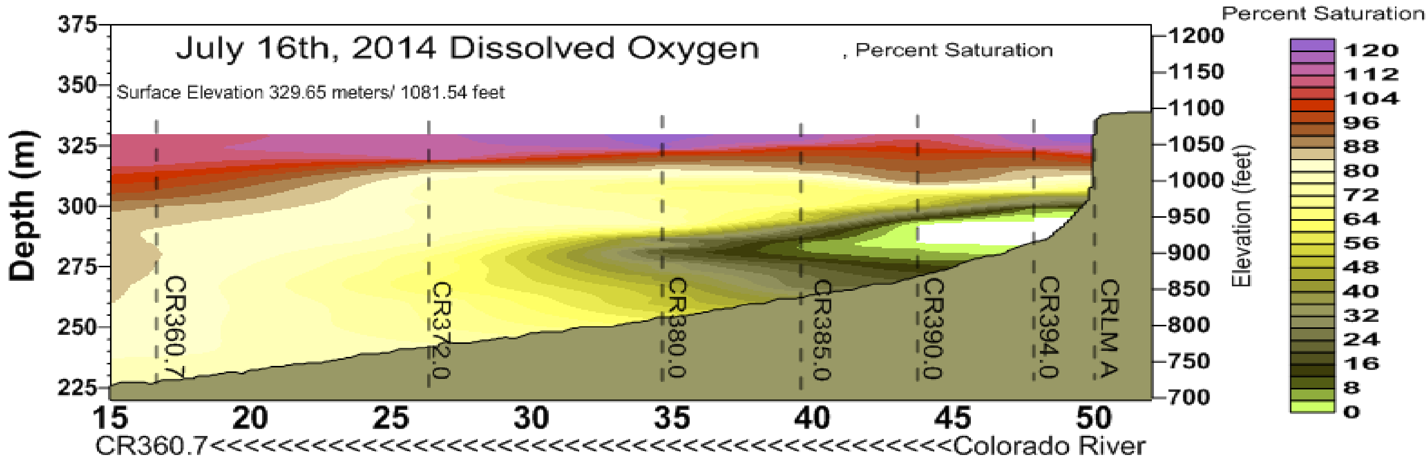

Low DO at the Colorado River Confluence